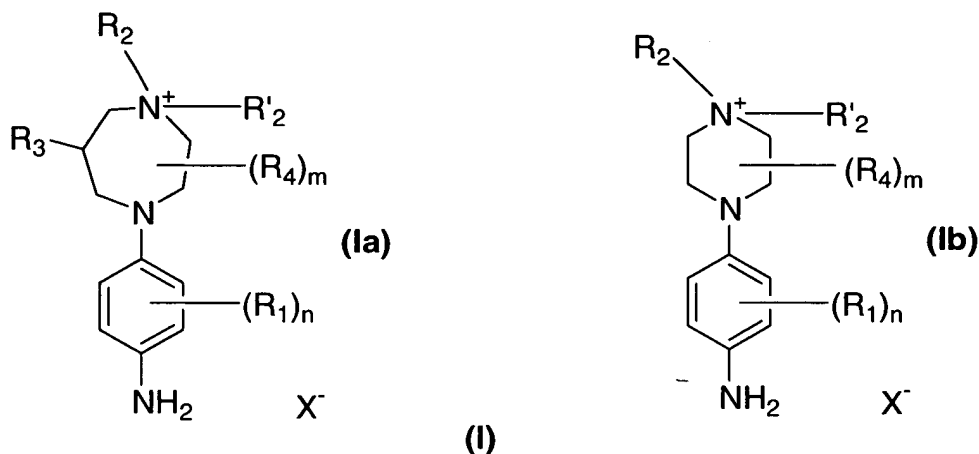


**WHAT IS CLAIMED IS:**

1. A composition for dyeing keratin fibres, comprising, in a cosmetic medium that is suitable for dyeing, at least one para-phenylenediamine derivative of formula (Ia), formula (Ib), and their addition salts:



wherein:

- $R_1$  is chosen from:
  - a halogen atom; and
  - saturated and unsaturated  $C_1$ - $C_8$  aliphatic and alicyclic hydrocarbon-based chains, wherein at least one carbon atom is optionally replaced with at least one entity chosen from oxygen, nitrogen, silicon, sulphur, and  $SO_2$  groups; and wherein  $R_1$  does not comprise peroxide bonds or diazo, nitro or nitroso radicals;
- $n$  ranges from 0 to 4, wherein, when  $n$  is greater than 1, each  $R_1$  may be identical or different;
- $R_2$  and  $R'_2$ , which may be identical or different, are chosen from:
  - saturated and unsaturated alkyl radicals, wherein saturated and unsaturated alkyl radicals may optionally be substituted with at least one radical chosen from carboxyls, alkylcarbonyls, alkoxycarbonyls, carbamoyls, monoalkylcarbamoyls and

dialkylcarbamoys, and saturated and unsaturated heterocyclic radicals comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom is chosen from nitrogen, oxygen, and sulphur; and  $-\text{CH}_2\text{R}$  radicals, wherein R is chosen from saturated and unsaturated alkyl radicals, substituted with at least one radical chosen from hydroxyls, alkoxys, thiols, halogens, aminos, monoalkylaminos, dialkylaminos and amino radicals with the amine substituted with a radical chosen from alkylcarbonyls, carbamyls and alkylsulphonyls;

- aryl radicals; and
- benzyl radicals;
- o  $\text{R}_3$  is chosen from:
  - a hydrogen atom;
  - optionally unsaturated alkyl radicals;
  - hydroxyl radicals;
  - hydroxyalkyl radicals;
  - alkoxy radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - amino radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - alkyl radicals substituted with at least one hydroxy radical and at least one amino radical;
  - monoalkylamino radicals;
  - dialkylamino radicals;

- aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
- carboxyl radicals;
- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxy carbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- $R_4$  is chosen from:
  - saturated and unsaturated alkyl radicals;
  - hydroxyalkyl radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - hydroxy radicals
  - aminoalkyl radicals;
  - carboxyl radicals;

- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxy carbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- m ranges from 0 to 4, wherein when m is greater than 1, each  $R_4$  may be identical or different; and
- $X^-$  is a counterion.

2. The composition according to claim 1, wherein n is equal to 0 or  $R_1$  is chosen from alkyl radicals, hydroxyalkyl radicals, aminoalkyl radicals, alkoxy radicals, and hydroxyalkoxy radicals.

3. The composition according to claim 2, wherein n is equal to 0 or  $R_1$  is chosen from methyl radicals, hydroxymethyl radicals, 2-hydroxyethyl radicals, 1,2-dihydroxyethyl radicals, methoxy radicals, isopropoxy radicals, and 2-hydroxyethoxy radicals.

4. The composition according to claim 1, wherein n is equal to 0 or 1.

5. The composition according to claim 1, wherein  $R_2$  is chosen from alkyl radicals and alkyl radicals substituted with a saturated or unsaturated heterocyclic radical comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom of which is chosen from nitrogen; oxygen; sulphur; and  $-CH_2R$  radicals, wherein R is an alkyl radical substituted with at least one hydroxyl radical.

6. The composition according to claim 5, wherein  $R_2$  is chosen from a 2-

hydroxyethyl radical, a 2,3-dihydroxypropyl radical, a 3-(1-pyrrolidiny)propyl radical, and a methyl radical.

7. The composition according to claim 1, wherein  $R'_2$  is chosen from saturated and unsaturated alkyl radicals and  $-CH_2R$  radicals, wherein R is an alkyl radical substituted with at least one group chosen from hydroxyls, aminos, monoalkylaminos and dialkylaminos.

8. The composition according to claim 7, wherein  $R'_2$  is chosen from a methyl radical, an ethyl radical, and a 2-hydroxyethyl radical.

9. The composition according to claim 1, wherein  $R_3$  is chosen from a hydrogen atom, alkyl radicals, hydroxyalkyl radicals, aminoalkyl radicals, carboxyl radicals, carbamoyl radicals, hydroxyl radicals, alkoxy radicals, amino radicals, monoalkylamino radicals, and dialkylamino radicals.

10. The composition according to claim 9, wherein  $R_3$  is chosen from a hydrogen atom, hydroxyl radicals, carboxyl radicals, carbamoyl radicals, amino radicals, hydroxymethyl radicals, and aminomethyl radicals.

11. The composition according to claim 1, wherein m is equal to 0 or  $R_4$  is chosen from alkyl radicals, hydroxyalkyl radicals, aminoalkyl radicals, carboxyl radicals, carbamoyl radicals, monoalkylcarbamoyl radicals, and dialkylcarbamoyl radicals.

12. The composition according to Claim 11, wherein m is equal to 0 or 1.

13. The composition according to claim 1, wherein the at least one para-phenylenediamine derivative is chosen from 4-(4-aminophenyl)-1-ethyl-1-methylpiperazin-1-ium chloride, 4-(4-aminophenyl)-1,1-dimethylpiperazin-1-ium chloride 4-(4-aminophenyl)-1,1-dimethyl[1,4]diazepan-1-ium chloride 4-(4-aminophenyl)-1,1-bis-(2-hydroxyethyl)-[1,4]diazepan-1-ium chloride 4-(4-aminophenyl)-6-hydroxy-1,1-dimethyl[1,4]diazepan-1-ium

chloride 4-(4-aminophenyl)-1-(2-methoxyethyl)-1-methylpiperazin-1-ium chloride 4-(4-aminophenyl)-1-(2-hydroxyethyl)-1-methyl[1,4]diazepan-1-ium chloride 4-(4-aminophenyl)-1,2-dimethyl-1-m-tolylpiperazin-1-ium chloride 4-(4-aminophenyl)-1-(2-hydroxyethyl)-1-methylpiperazin-1-ium chloride 4-(4-aminophenyl)-1,1-bis-(2-hydroxyethyl)piperazin-1-ium chloride 4-(4-aminophenyl)-1,2-dimethyl-1-m-tolylpiperazin-1-ium chloride 4-(4-aminophenyl)-1-ethyl-1-(2-hydroxyethyl)piperazin-1-ium chloride 4-(4-aminophenyl)-1-(2-hydroxyethyl)-1-ethyl[1,4]diazepan-1-ium chloride 4-(4-aminophenyl)-1-methyl-1-(3-pyrrolidin-1-ylpropyl)[1,4]diazepan-1-ium chloride 4-(4-aminophenyl)-1-methyl-1-(3-pyrrolidin-1-ylpropyl)piperazin-1-ium chloride 4-(4-aminophenyl)-1-carbamoylmethyl-1-methylpiperazin-1-ium chloride 4-(4-amino-3-methylphenyl)-1-ethyl-1-methylpiperazin-1-ium chloride 4-(4-amino-3-methylphenyl)-1,1-dimethylpiperazin-1-ium chloride 4-(4-amino-3-methylphenyl)-1,1-dimethyl[1,4]diazepan-1-ium chloride 4-(4-amino-3-methylphenyl)-1,1-bis-(2-hydroxyethyl)[1,4]diazepan-1-ium chloride 4-(4-amino-3-methylphenyl)-6-hydroxy-1,1-dimethyl[1,4]diazepan-1-ium chloride 4-(4-amino-3-methylphenyl)-1-(2-methoxyethyl)-1-methylpiperazin-1-ium chloride 4-(4-amino-3-methylphenyl)-1-(2-hydroxyethyl)-1-methyl[1,4]diazepan-1-ium chloride 4-(4-amino-3-methylphenyl)-1,2-dimethyl-1-m-tolylpiperazin-1-ium chloride, 4-(4-amino-3-methylphenyl)-1-(2-hydroxyethyl)-1-methylpiperazin-1-ium chloride, 4-(4-amino-3-methylphenyl)-1,1-bis-(2-hydroxyethyl)piperazin-1-ium chloride, 4-(4-amino-3-methylphenyl)-1,2-dimethyl-1-m-tolylpiperazin-1-ium chloride, 4-(4-amino-3-methylphenyl)-1-ethyl-1-(2-hydroxyethyl)piperazin-1-ium chloride, 4-(4-amino-3-methylphenyl)-1-(2-hydroxyethyl)-1-ethyl[1,4]diazepan-1-ium chloride, 4-(4-amino-3-methylphenyl)-1-methyl-1-(3-pyrrolidin-1-ylpropyl)[1,4]diazepan-1-ium chloride, 4-(4-amino-3-methylphenyl)-1-methyl-1-(3-pyrrolidin-1-ylpropyl)piperazin-1-ium chloride, and 4-(4-amino-3-aminophenyl)-1-carbamoylmethyl-1-methylpiperazin-1-ium chloride.

14. The composition according to claim 13, wherein the at least one para-phenylenediamine derivative is chosen from 4-(4-aminophenyl)-1,1-dimethyl[1,4]diazepan-1-ium chloride, 4-(4-aminophenyl)-1,1-dimethylpiperazin-1-ium chloride, and 4-(4-aminophenyl)-1-(2-hydroxyethyl)-1-methylpiperazin-1-ium chloride.

15. The composition according to claim 1, further comprising at least one coupler chosen from meta-phenylenediamines, meta-aminophenols, meta-diphenols, naphthalene-based couplers, and heterocyclic couplers, and the addition salts thereof.

16. The composition according to claim 15, wherein the amount of the at least one coupler ranges from 0.001% to 10% by weight relative to the total weight of the dye composition.

17. The composition of claim 16, wherein the amount of the at least one coupler ranges from 0.005% to 6% by weight relative to the total weight of the dye composition.

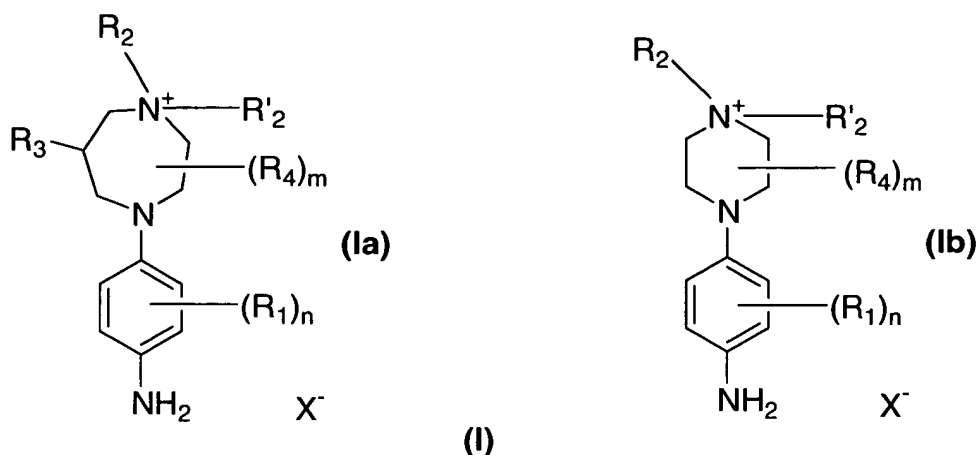
18. The composition according to claim 1, further comprising at least one additional oxidation base other than the the at least one para-phenylenediamine derivative, chosen from para-phenylenediamines, bis(phenyl)alkylenediamines, para-aminophenols, bis-para-aminophenols, ortho-aminophenols, ortho-phenylenediamines and heterocyclic bases, and the addition salts thereof.

19. The composition according to claim 18, wherein the amount of the at least one additional oxidation base ranges from 0.001% to 10% by weight relative to the total weight of the dye composition.

20. The composition according to claim 19, wherein the amount of the at least one additional oxidation base ranges from 0.005% to 6% by weight relative to the total weight of the dye composition.

21. A process for dyeing keratin fibres comprising applying a composition to

keratin fibres in the presence of an oxidizing agent, for a time that is sufficient to develop a desired coloration, the composition comprising, in a cosmetic medium that is suitable for dyeing, at least one para-phenylenediamine derivative of formula (Ia), formula (Ib), and their addition salts:



wherein:

- $R_1$  is chosen from:
  - a halogen atom; and
  - saturated and unsaturated  $C_1$ - $C_8$  aliphatic and alicyclic hydrocarbon-based chains, wherein at least one carbon atom is optionally replaced with at least one entity chosen from oxygen, nitrogen, silicon, sulphur, and  $SO_2$  groups; and wherein  $R_1$  does not comprise peroxide bonds or diazo, nitro or nitroso radicals;
- $n$  ranges from 0 to 4, wherein, when  $n$  is greater than 1, each  $R_1$  may be identical or different;
- $R_2$  and  $R'_2$ , which may be identical or different, are chosen from:
  - saturated and unsaturated alkyl radicals, wherein saturated and unsaturated alkyl radicals may be optionally be substituted with at least one radical chosen from carboxyls, alkylcarbonyls, alkoxycarbonyls, carbamoyls, monoalkylcarbamoyls and

dialkylcarbamoys, and saturated and unsaturated heterocyclic radicals comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom is chosen from nitrogen, oxygen, and sulphur; and  $-\text{CH}_2\text{R}$  radicals, wherein R is chosen from saturated and unsaturated alkyl radicals, substituted with at least one radical chosen from hydroxyls, alkoxys, thiols, halogens, aminos, monoalkylaminos, dialkylaminos and amino radicals with the amine substituted with a radical chosen from alkylcarbonyls, carbamyls and alkylsulphonyls;

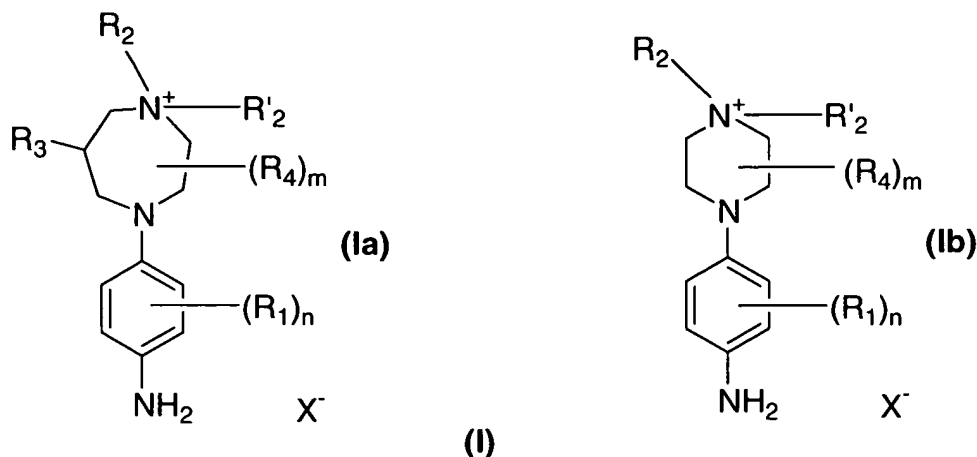
- aryl radicals; and
- benzyl radicals;
- $\text{R}_3$  is chosen from:
  - a hydrogen atom;
  - optionally unsaturated alkyl radicals;
  - hydroxyl radicals;
  - hydroxyalkyl radicals;
  - alkoxy radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - amino radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - alkyl radicals substituted with at least one hydroxy radical and at least one amino radical;
  - monoalkylamino radicals;
  - dialkylamino radicals;

- aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
- carboxyl radicals;
- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxycarbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- $R_4$  is chosen from:
  - saturated and unsaturated alkyl radicals;
  - hydroxyalkyl radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - hydroxy radicals
  - aminoalkyl radicals;
  - carboxyl radicals;

- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxycarbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- m ranges from 0 to 4, wherein when m is greater than 1, each  $R_4$  may be identical or different; and
- $X^-$  is a counterion.

22. The process according to claim 21, wherein the oxidizing agent is chosen from hydrogen peroxide, urea peroxide, alkali metal bromates, persalts, peracids and oxidase enzymes.

23. A multi-compartment device comprising a first compartment comprising a composition for dyeing keratin fibres, and a second compartment comprising an oxidizing agent, the composition for dyeing keratin fibres comprising, in a cosmetic medium that is suitable for dyeing, at least one para-phenylenediamine derivative of formula (Ia), formula (Ib), and their addition salts:



wherein:

- $R_1$  is chosen from:
  - a halogen atom; and
  - saturated and unsaturated  $C_1$ - $C_8$  aliphatic and alicyclic hydrocarbon-based chains, wherein at least one carbon atom is optionally replaced with at least one entity chosen from oxygen, nitrogen, silicon, sulphur, and  $SO_2$  groups; and wherein  $R_1$  does not comprise peroxide bonds or diazo, nitro or nitroso radicals;
- $n$  ranges from 0 to 4, wherein, when  $n$  is greater than 1, each  $R_1$  may be identical or different;
- $R_2$  and  $R'_2$ , which may be identical or different, are chosen from:
  - saturated and unsaturated alkyl radicals, wherein saturated and unsaturated alkyl radicals may be optionally be substituted with at least one radical chosen from carboxyls, alkylcarbonyls, alkoxycarbonyls, carbamoyls, monoalkylcarbamoyls and dialkylcarbamoyls, and saturated and unsaturated heterocyclic radicals comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom is chosen from nitrogen, oxygen, and sulphur; and  $-CH_2R$  radicals, wherein  $R$  is chosen from saturated and unsaturated alkyl radicals, substituted with at least one radical chosen from

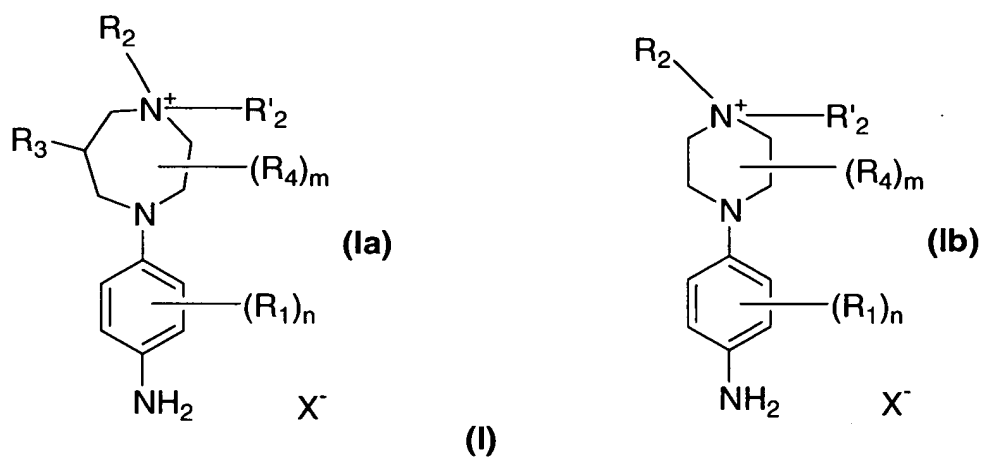
hydroxyls, alkoxys, thiols, halogens, aminos, monoalkylaminos, dialkylaminos and amino radicals with the amine substituted with a radical chosen from alkylcarbonyls, carbamyls and alkylsulphonyls;

- aryl radicals; and
- benzyl radicals;
- $R_3$  is chosen from:
  - a hydrogen atom;
  - optionally unsaturated alkyl radicals;
  - hydroxyl radicals;
  - hydroxyalkyl radicals;
  - alkoxy radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - amino radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - alkyl radicals substituted with at least one hydroxy radical and at least one amino radical;
  - monoalkylamino radicals;
  - dialkylamino radicals;
- aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
- carboxyl radicals;

- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxycarbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- $R_4$  is chosen from:
  - saturated and unsaturated alkyl radicals;
  - hydroxyalkyl radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - hydroxy radicals
  - aminoalkyl radicals;
  - carboxyl radicals;
  - carboxyalkyl radicals;
  - carbamoyl radicals;
  - carbamoylalkyl radicals;
  - alkoxycarbonyl radicals;

- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- m ranges from 0 to 4, wherein when m is greater than 1, each  $R_4$  may be identical or different; and
- $X^-$  is a counterion.

24. At least one para-Phenylenediamine derivative of formula (Ia), formula (Ib), and their addition salts:



wherein:

- $R_1$  is chosen from:
  - a halogen atom; and
  - saturated and unsaturated  $C_1$ - $C_8$  aliphatic and alicyclic hydrocarbon-based chains, wherein at least one carbon atom is optionally replaced with at least one entity chosen from oxygen, nitrogen, silicon, sulphur, and  $SO_2$  groups; and wherein  $R_1$  does not comprise peroxide bonds or diazo, nitro or nitroso radicals;
- n ranges from 0 to 4, wherein, when n is greater than 1, each  $R_1$  may be identical

or different;

- $R_2$  and  $R'_2$ , which may be identical or different, are chosen from:
  - saturated and unsaturated alkyl radicals, wherein saturated and unsaturated alkyl radicals may be optionally be substituted with at least one radical chosen from carboxyls, alkylcarbonyls, alkoxycarbonyls, carbamoyls, monoalkylcarbamoyls and dialkylcarbamoyls, and saturated and unsaturated heterocyclic radicals comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom is chosen from nitrogen, oxygen, and sulphur; and  $-CH_2R$  radicals, wherein R is chosen from saturated and unsaturated alkyl radicals, substituted with at least one radical chosen from hydroxyls, alkoxys, thiols, halogens, aminos, monoalkylaminos, dialkylaminos and amino radicals with the amine substituted with a radical chosen from alkylcarbonyls, carbamyls and alkylsulphonyls;
  - aryl radicals; and
  - benzyl radicals;
- $R_3$  is chosen from:
  - a hydrogen atom;
  - optionally unsaturated alkyl radicals;
  - hydroxyl radicals;
  - hydroxyalkyl radicals;
  - alkoxy radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - amino radicals, wherein the amine is optionally monosubstituted or disubstituted

with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;

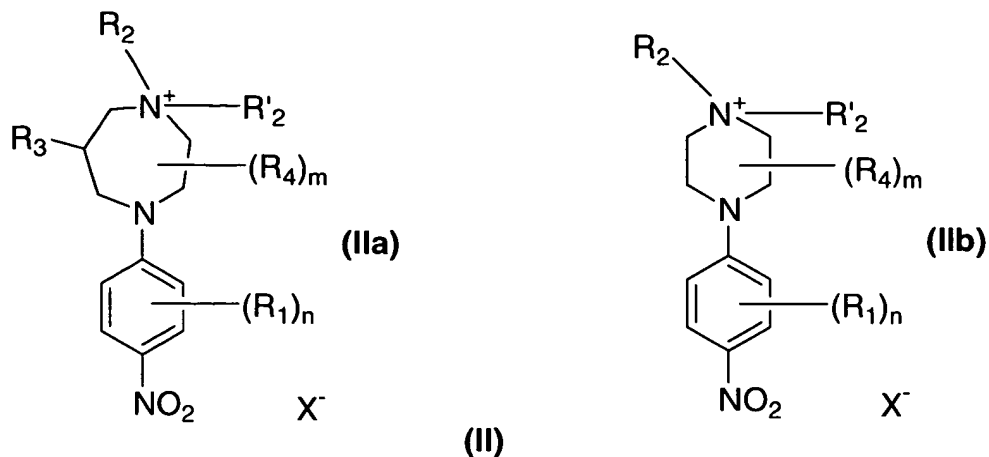
- alkyl radicals substituted with at least one hydroxy radical and at least one amino radical;
- monoalkylamino radicals;
- dialkylamino radicals;
- aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
- carboxyl radicals;
- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxycarbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- o  $R_4$  is chosen from:
  - saturated and unsaturated alkyl radicals;
  - hydroxyalkyl radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or

disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;

- hydroxy radicals
- aminoalkyl radicals;
- carboxyl radicals;
- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxycarbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- m ranges from 0 to 4, wherein when m is greater than 1, each  $R_4$  may be identical or different; and
- $X^-$  is a counterion.

wherein the at least one para-phenylenediamine derivative is not substituted with a diazacyclohexane ring wherein n is equal to 0, m is equal to 0 and  $R_2$  and  $R'_2$  are methyl radicals.

24. At least one para-Nitroaniline derivative of formula (IIa), (IIb), and their addition salts:



wherein:

- $R_1$  is chosen from:
  - a halogen atom; and
  - saturated and unsaturated  $C_1$ - $C_8$  aliphatic and alicyclic hydrocarbon-based chains, wherein at least one carbon atom is optionally replaced with at least one entity chosen from oxygen, nitrogen, silicon, sulphur, and  $SO_2$  groups; and wherein  $R_1$  does not comprise peroxide bonds or diazo, nitro or nitroso radicals;
- $n$  ranges from 0 to 4, wherein, when  $n$  is greater than 1, each  $R_1$  may be identical or different;
- $R_2$  and  $R'_2$ , which may be identical or different, are chosen from:
  - saturated and unsaturated alkyl radicals, wherein saturated and unsaturated alkyl radicals may be optionally be substituted with at least one radical chosen from carboxyls, alkylcarbonyls, alkoxycarbonyls, carbamoyls, monoalkylcarbamoyls and dialkylcarbamoyls, and saturated and unsaturated heterocyclic radicals comprising 4, 5, 6 or 7 atoms, wherein at least one hetero atom is chosen from nitrogen, oxygen, and sulphur; and  $-CH_2R$  radicals, wherein  $R$  is chosen from saturated and unsaturated alkyl radicals, substituted with at least one radical chosen from

hydroxyls, alkoxys, thiols, halogens, aminos, monoalkylaminos, dialkylaminos and amino radicals with the amine substituted with a radical chosen from alkylcarbonyls, carbamyls and alkylsulphonyls;

- aryl radicals; and
- benzyl radicals;
- $R_3$  is chosen from:
  - a hydrogen atom;
  - optionally unsaturated alkyl radicals;
  - hydroxyl radicals;
  - hydroxyalkyl radicals;
  - alkoxy radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - amino radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - alkyl radicals substituted with at least one hydroxy radical and at least one amino radical;
  - monoalkylamino radicals;
  - dialkylamino radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - carboxyl radicals;

- carboxyalkyl radicals;
- carbamoyl radicals;
- carbamoylalkyl radicals;
- alkoxy carbonyl radicals;
- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- $R_4$  is chosen from:
  - saturated and unsaturated alkyl radicals;
  - hydroxyalkyl radicals;
  - alkoxyalkyl radicals;
  - alkylcarbonyl radicals;
  - hydroxyalkoxyalkyl radicals;
  - aminoalkyl radicals, wherein the amine is optionally monosubstituted or disubstituted with a radical chosen from alkyl radicals, acetyl radicals and hydroxyalkyl radicals;
  - hydroxy radicals
  - aminoalkyl radicals;
  - carboxyl radicals;
  - carboxyalkyl radicals;
  - carbamoyl radicals;
  - carbamoylalkyl radicals;
  - alkoxy carbonyl radicals;

- monoalkylaminocarbonyl radicals;
- dialkylaminocarbonyl radicals;
- monoalkylaminocarbonylalkyl radicals; and
- dialkylaminocarbonylalkyl radicals;
- m ranges from 0 to 4, wherein when m is greater than 1, each  $R_4$  may be identical or different; and
- $X^-$  is a counterion

wherein the at least one paraphenylenediamine is not 4-(4-nitrophenyl)-1,1-dimethylpiperazin-1-ium.